Massachusetts Large Whale Conservation Program

NOAA Grant No. NA10NMF4720147

Final Report: July 1, 2010 – June 30, 2011

Principal Investigator – Erin Burke

Massachusetts Division of Marine Fisheries
1213 Purchase St. - 3rd Floor New Bedford, MA 02740
508-990-2860 x 134
Erin.Burke@state.ma.us

Federal Assistance Coordinator – Stephanie Cunningham

Massachusetts Division of Marine Fisheries
Annisquam River Marine Fisheries Station
30 Emerson Ave.
Gloucester, MA 01930
978-282-0308 x 133
Stephanie.Cunningham@state.ma.us

Submitted to NOAA: November 2011

The Massachusetts Division of Marine Fisheries (*MarineFisheries*), partnered with the Provincetown Center for Coastal Studies (PCCS), continues to conduct the Massachusetts Large Whale Conservation Program with the goal of advancing the management of endangered large whales in Massachusetts state and adjacent waters. The program is comprised of three mutually supportive long-term projects with direct conservation impact: population studies including surveillance of right whales during winter/spring in Cape Cod Bay and surrounding waters; right whale feeding habitat assessment and forecasting coupled with studies of the conditions that increase the risk of entanglement and ship strike; and entanglement documentation, readiness, and response year round in waters from New Hampshire to Rhode Island. During the six-month reporting period 29 aerial surveys were completed, 17 habitat monitoring cruises were conducted, 2 right whales and 3 humpbacks were completely or partially disentangled, and a total of 13 entanglement cases were documented. The season was notable for the long residency and large number of right whales photo documented in Cape Cod Bay and surrounding state waters; this period of residency was associated with a steady and unusually long period of enriched food resource dominated by the three principal copepod taxa. For the past 7 years of study (with the exception of 2010) the number of right whales has steadily increased; in 2011 more than 65% of the estimated right whales in the North Atlantic Ocean were documented in the waters around Cape Cod and the islands during the winter and early spring. The observations of the 2011 season highlight the importance of the area covered by the Massachusetts Large Whale Conservation Program as an effective capture point for a large segment of the North Atlantic right whale population, including entangled individuals; thus, the findings and actions of the 2011 program were directly supportive of diverse conservation efforts throughout the entire range of the species.

RIGHT WHALE STUDIES PROGRAM

Preparations for the 2011 aerial field season included designing aerial surveys for the area spanning Rhode Island Sound and the area south of Martha's Vineyard and Nantucket (see figure 1). Planning prior to the 2011 season was aimed at the region south of the islands both in response to the large number of right whales seen in Rhode Island Sound in the spring of 2010 and because this area has been designated as a target for development of alternative energy installations. Weather and abundance of right whales in the regular Cape Cod Bay survey area prevented us from flying the proposed survey scheme; however a modified version of it was used (see figure 2). Increased survey efforts east of Cape Cod, along the Provincetown Slope, were planned for the 2011 season in response to an apparent increase in the number of animals sighted in the area in 2010. In addition to this more adaptive survey effort, PCCS chose to modify its survey methods for the 2011 season. Specifically transects in 2011were flown at 1000 feet (as opposed to 750 feet). This change more closely matches other aerial surveys conducted on right whales, making data more comparable throughout their range.

During the 2011 right whale field season 29 surveys, complete or incomplete, were flown by the PCCS Right Whale Studies Program between January 1 and May 25 (see figure 2). Twenty-three of these surveys concentrated on Cape Cod Bay, five focused on tracklines east of Cape Cod, and one survey was conducted in Nantucket Sound, south of Martha's Vineyard and Nantucket, in response to observations

of right whales reported to NMFS. During the report period 149.6 hours were flown, of which 125.4 hours were spent on survey. Right whales were documented on 24 of the 29 aerial surveys in 2011. The first right whale sighted on a directed survey was recorded in Cape Cod Bay on January 17, 2011. Right whales were last seen in Cape Cod Bay on May 3.

Preliminary data analysis at PCCS indicates that during the 2011 right whale field season, approximately 65% (n=311) of the estimated North Atlantic right whale population was documented by PCCS in Cape Cod Bay and the adjacent Massachusetts waters (Pettis, 2010); this number includes right whales seen by all PCCS research teams (aerial and shipboard). Due to the large number of animals sighted during the 2011 season, photo-analysis is still underway. For the purpose of this report only animals matched to the catalog or given inter-match codes were considered so the total number of identified individuals will likely increase as analysis continues. At the time of this report, the New England Aquarium has confirmed 182 of the 311 identifications suggested by PCCS. The number of animals documented thus far is an increase from the previous three years, when nearly half of the estimated right whale population had been seen yearly in Cape Cod Bay and adjacent waters (45% Stamieszkin et al. 2010, 49% Leeney et al. 2009, 40% Leeney et al. 2008). The abundance of right whales documented by PCCS continues to suggest the management importance of Cape Cod Bay and the adjacent Massachusetts waters as a winter and spring habitat for the species. In addition to documenting right whales, all marine mammals were recorded. It should be noted that a greater-than-usual abundance of sei whales was documented during the 2011 season. Sei whales were documented in all habitats surveyed, and on multiple survey days, throughout April and May.

The demographics of the whales in the preliminary matching at PCCS are as follows: of the 311 individuals documented in 2011, 144 were male, 83 were female, and 84 were of unknown sex. The age classes can be separated into 9 calves, 87 juveniles, 180 adults, and 35 of unknown age (North Atlantic Right Whale Consortium). Of the 21 calves documented in the southeast during 2011, nine were seen with their mothers in Cape Cod Bay and adjacent waters (#'s 1243, 1911, 2040, 2660, 2790, 3115, 3240, 3293, and 3430). Additionally, one 2011 mother (#3130) was seen without her calf. She was documented by PCCS on one survey, south of Martha's Vineyard and Nantucket. Seven entangled right whales cases were documented by the aerial survey team (#'s 1980, 3120, 3123, 3712, 3760, 3893, and S044) the details of these cases can be found in the entanglement response section below.

The number of right whales per 100 nm of effort increased in 2011 when compared with all previous years of the project (4.64/100 nm; see figure 3). Right whales in Cape Cod Bay reached peak abundance in late April (84.11/100nm; Figure 4). However, the survey aircraft was grounded for maintenance for the first two weeks of April, during which time vessel-based PCCS research teams observed a large number of right whales using the Cape Cod Bay habitat. For the second consecutive year, there was a sharp increase in right whale abundance in late January/early February (8.43/100nm, see figure 4); previous to 2010 this pattern was last observed in 2001 (22.03/100nm, Brown et al. 2001). This season, the distribution of right whales was heavily concentrated in the eastern portion of Cape Cod Bay (see figure 2), which, over years of the project, has been typical (Leeney et al., 2009).

During the 2011 season, the aerial team flew one survey in Nantucket Sound, south of Martha's Vineyard and Nantucket after NMFS had received reports of right whales in Nantucket Sound. No right whales were sighted in Nantucket Sound by PCCS, but thirteen right whales were sighted south of Martha's Vineyard and Nantucket.

To further confirm identifications of individual right whales, all photographs taken by PCCS were submitted to New England Aquarium for inclusion in the North Atlantic right whale catalog as part of the collaborative effort to monitor the population. Right whale sighting data, as well as data pertaining to fishing gear (see figure 5), and other marine mammals (see figure 6) were submitted to the North Atlantic Right Whale Consortium database, and are also archived in-house. All right whale sightings were reported to NMFS SAS in near real-time.

Preparations for the 2012 field season are underway and include continuation of subcontracts with the New England Aquarium, to confirm aerial and vessel-based photo-identification and with New England Specialized Aviation Services, Inc. (NESAS) for pilot/plane services.

Aerial surveys conducted under NMFS scientific research permit #14603

RIGHT WHALE HABITAT PROGRAM

Preparations for the 2011 habitat program field season included analysis of the major findings from previous years, which dictated the structure of the data collection for this season. Skim and subsurface feeding increased in March and April, with higher observations in the early and later parts of the day (Leeney et al., 2008 & 2009). Such cyclic behavior suggests a diel vertical migration of copepods (Williams & Conway, 1984; Durbin et al., 1995; Hays et al., 1997). Since the diel vertical migration (DVM) influences the exposure of right whales to their principal causes of risk (ship strikes and entanglements) planning during the reporting period centered upon development of new methods for defining the (DVM) of the resource and associated whale behavior.

The 2011 right whale field season purpose was to continue the long-term study of the ecology of the Cape Cod Bay critical habitat, the winter residency area for right whales, and to investigate the influence of the vertical distribution and composition of zooplankton food resources on the risk of ship strike and entanglement. Ongoing research continued to focus on characterizing the distribution, composition, and density of the winter-spring Cape Cod Bay zooplankton resource, while increased effort was placed on studies of the vertical structure of the zooplankton resource. Seventeen habitat study cruises were conducted, during which 687 zooplankton samples were collected and analyzed to describe the food resources that control the distribution of right whales in Cape Cod Bay (see table 1).

During the 2011 season zooplankton samples were collected by surface and oblique net tows at eight regular stations throughout the Bay, and by pump for collection of near-surface horizontal transect and discrete water-column samples in locations of particular interest for the study of zooplankton-right whale ecology and to document the influence of vertical migration of the prey on right whale behavior. The results of the field collections and zooplankton analyses were broadly distributed via email to the Division of Marine Fisheries of the Commonwealth of Massachusetts (DMF) and to more than 80

colleagues as "Preliminary Assessment" and "Right Whale Risk Alert" reports. These reports continued our effort to alert the Division of Marine Fisheries of areas that present a risk of ship strike or entanglement by forecasting aggregation and feeding by right whales.

The Right Whale Risk Alerts, embedded in the Preliminary Assessments, notify DMF of the likelihood of dense aggregations of feeding whales in areas of high vessel activity within Cape Cod Bay and adjacent areas. Based on these reports, DMF evaluates the need to issue an advisory to mariners, notifying them about the increased risk of vessel collision due to right whale abundance, behavior, and food resources. We disseminate this information to fishermen, boaters and others through a variety of channels including the DMF list serv, press releases, media interviews, local harbormasters, the Cape Cod Canal Army Corps of Engineers, the US Coast Guard, etc. It was recently brought to our attention that the NMFS Northeast Regional Office has not been receiving notification of these alerts. In the future we will remedy that oversight.

In April 2011, there was a high density of right whales in the eastern quadrants of the bay coupled with a deep zooplankton resource, uniformly distributed between 0 and 10+ meters. A large number of samples exceeded the right whale feeding threshold, and there was a preponderance of observations of feeding whales at or near the surface.

Preliminary assessments were prepared by reviewing zooplankton quality information and right whale distribution and behavior reports provided by the aerial survey team at PCCS. Based upon these reports from PCCS, on April 15 Massachusetts DMF issued an Alert (see Attachment A). During the period of the Alert, zooplankton conditions that supported the high concentration of whales in the eastern portions of Cape Cod Bay were reviewed after each cruise.

Table 1. Number of Advisories to Mariners Issued by DMF

YEAR	April	May
2006	1	1
2007	1	1
2008	3	0
2009	1	0
2010	1	0
2011	1	0

In 2011, the zooplankton resource generally followed previously documented patterns of enrichment and diminution (see figure 7). The pattern of productivity of the primary food resources (*Calanus finmarchicus*, *Pseudocalanus* spp., and *Centropages* spp.) overlapped as in past years, but the *Pseudocalanus* spp. resource remained abundant well past the usual time of depletion in mid-April (see figures 8 & 9). The extension of the *Pseudocalanus* season coupled with the usual rise in *Calanus* resulted in a generally enriched food resource capable of supporting right whale feeding activity and residency for a longer than usual period of time. As was the case in 2010, but in contrast to previous years, the density of zooplankton in the surface waters was generally greater than that of the water

column, suggesting the coupling of oceanographic /biological processes that increase the exposure of right whales to risk of ship strike.

Because habitat-wide sampling cruises were limited in favor of directed studies of the water column and the layering of the zooplankton resource during the peak residency of right whales, it is likely that bay-wide mean zooplankton densities under-represent the actual mean zooplankton densities during the peak periods feeding in 2011.Therefore an accurate comparison of enrichment pattern of the 2011 food resource with that of other years was not possible. The preliminary analysis of the zooplankton's diel vertical profile displayed high average concentrations of enrichment in the surface (0-1m) and upper-mid water column (1.1 – 6m) in the morning hours (0600 – 1159 hrs.), with decreasing concentrations of zooplankton at any depth and apparent dispersion of the resource as the day progresses through the afternoon (1200 – 1659 hrs.) and late afternoon/evening (1700 – 2000 hrs.) (see table 2). *Calanus finmarchicus* and *Pseudocalanus* spp. displayed similar characteristics through the day while *Centropages* spp. displayed an inverse pattern. Eighty-six percent of the overall right whale behavior during water column sample collection was recorded as skim or sub-surface feeding.

The preliminary 2011 studies of the movement of the zooplankton resource and the behavioral response of right whales suggest the importance of understanding the influence of zooplankton structure and aggregation as it impacts the exposure of right whales to ship strike and entanglement. Under the influence of changes in zooplankton depth selection and layer formation right whales change behavior in predictable ways outlined in a manuscript in final prep (Stamieszkin et. al, in prep). The findings of 2011 suggest the importance of understanding the proximal conditions, particularly those related to the zooplankton resource, in the ongoing effort to understand and ultimately mitigate the exposure of right whales to the risk of ship strike and entanglement. Based on the findings of the 2011 season, in 2012 we anticipate increasing our field effort to better document the relationship between the movements and structure of the zooplankton resource and depth selective behavior of right whales that exposes them to risk. Overall, the 2011 season was characterized by steady levels of zooplankton with an unusually long duration of right whale presence in Cape Cod Bay. Database consolidation continued throughout the 2010 – 2011 season, with the restructuring of a centralized database close to completion. Analysis of the reconstructed database will likely reveal long-term trends in the North Atlantic right whale's food resource in Cape Cod Bay.

WHALE ENTANGLEMENT RESPONSE

Between July 1, 2010 and June 30, 2011 the PCCS response team maintained daily readiness and response with a minimum of 3 trained responders, appropriate safety equipment, documentation media, disentanglement tools and access to a response vessel (*R/V Ibis* and *R/V Shearwater* when necessary). Through over 20 on-water responses three humpback and two right whale entanglement cases were resolved or partially resolved (WR-2010-11, WR-2010-13, WR-2010-19, WR-2011-10, WR-2011-11) and three whales (one humpback and two right whales) were confirmed to have shed gear on their own (WR-2010-09, WR-2008-05, WR-2010-12, WR-2011-02) during the reporting period. The Massachusetts entanglement reporting hotline was staffed by the response team throughout this period, fielding calls that were solicited through a variety of outreach efforts. All confirmed entangled

whale reports were immediately shared with National Marine Fisheries (NMFS) and subsequently shared with *MarineFisheries*. Samples collected during responses were remanded to NMFS (in the case of gear samples) or appropriately archived or sub-sampled and shared with collaborators (in the case of biological samples) for ongoing research and monitoring. Disentanglement activities were conducted under approved techniques and no human or whale injuries occurred (NOAA permit 932-1905/MA-009526).

Distribution of disentanglement tools to the Atlantic Large Whale Disentanglement Network (ALWDN) continued in collaboration with NMFS. PCCS advanced-level responders were available at all times to discuss and assess ongoing or otherwise complicated entanglement cases from throughout the range of ALWDN and participation in network advancement referrals. The PCCS response team maintained its emphasis on safe readiness and response and enhanced in-house training efforts in this regard. All data associated with entanglement reports and disentanglement activities were cataloged and archived for research, permit reporting, legal and management purposes and information from all confirmed sightings was shared with NMFS and the ALWDN via email and the network web site.

During the reporting period the Massachusetts entanglement hotline received over 200 reports of marine animals in trouble (including entanglements, strandings, out of habitat animals, carcasses, etc.). Through detailed follow-up interviews response staff confirmed that of these reports 39 were entanglement-related sightings, involving 22 individuals: nine rights, 10 humpbacks (one individual was entangled twice) and two minke whales, within or adjacent to the response area (see figure 10 for confirmed entangled whale sightings during the reporting period in the southern Gulf of Maine). Information from all of these confirmed or in-progress sightings was immediately shared with appropriate agency personnel. Within the Massachusetts response area five cases were disentangled, or partially disentangled. Status and response effort for local confirmed cases is detailed below (see also figure 10):

WR-2010-08: Humpback whale, Swallowtail, Great South Channel, 7/5/2010. Whale sighted by recreational boaters. PCCS attempted to disentangle but gear was extremely short and whale became evasive; whale was lost at sunset. (Whale was seen gear-free outside of this grant period)

WR-2010-09: Humpback whale, Vault, Great South Channel and Stellwagen Bank on 7/23, 7/30, 8/7 and 10/19/2010. No responses could be mounted during first three sightings due to engine difficulty, time of day and sea state, respectively. Whale was then opportunistically seen gear-free during PCCS research survey.

WR-2010-10: Humpback whale, no ID possible, Great South Channel, 7/26/2010. Whale sighted by recreational boaters and no response could be mounted due to sea state. This is the only case during the reporting period for which no photo-documentation exists but gear description was detailed.

WR-2010-11: Humpback whale, ’07 calf of Nocturne, Great South Channel, 7/27/2010. Whale was sighted by PCCS whale survey and attempts to disentangle were unsuccessful at that time. Whale seen again during a survey on 8/11. Flying cutter was used to cut body wrap and was confirmed disentangled on 8/31 (see WR-2010-19, below).

WR-2010-12: Humpback whale, Sodapop, Stellwagen Bank, 7/27/2010. Whale seen by PCCS on 5/2/2011, gear-free.

WR-2010-13: Humpback, no ID possible, Great South Channel, 8/13/2010. Whale sighted by recreational boaters. PCCS responded but gear gave way during disentanglement. Unclear if remaining gear is life-threatening or not. Gear sent to NMFS.

WR-2010-17: Humpback whale, '08 calf of Trident, Stellwagen Bank, 8/20, 9/30, 10/11/2010. PCCS responded on three occasions without success – whale had very short trailing gear so no workline could be established even with opportunistic aerial support of NEFSC.

WR-2010-18: Minke whale, Cape Cod Bay, 8/21 and 8/26/2010. Whale originally sighted by whale watch vessel, PCCS responded but could not establish a workline to the free-swimming whale. Whale opportunistically resighted also in Cape Cod Bay during a turtle disentanglement but attempts to disentangle were unsuccessful.

WR-2010-19: Humpback whale, '07 calf of Nocturne, Great South Channel, 8/31/2010. This represented a new entanglement for this individual. PCCS responded and removed all gear. Gear was sent to NMFS.

WR-2010-20: Right whale, #1503, Jeffreys Ledge, 9/10/2010. Whale sighted by whale watch vessel. PCCS responded but turned back due to rough seas.

WR-2010-21: Right whale, #3120, Jeffreys Ledge, 10/20/2010. During report period this whale was sighted on 4/19/2011 and 4/22/2011 (sightings were discovered during photo-analysis). Entanglement status of this individual is unknown.

WR-2011-10: Right whale #3893, Cape Cod Bay, 3/17/2011. Whale with very cryptic entanglement – case discovered from photo-analysis on 3/17, 4/10 and 4/19. Whale recognized in the field on 4/24. PCCS mounted response and made a single cut. Subsequent sightings on 4/25 and 4/29 confirmed that whale had shed remaining gear.

WR-2011-08: Humpback whale, no ID, 4/11/2011, off Cape Ann, MA. Whale was sighted by beachgoers. PCCS could not mount a response due to time of day and distance from port.

WR-2008-05: Right whale #1980, 4/19/2011, Cape Cod Bay. Whale sighted gear-free!

WR-2011-11: Right whale #SO44, 4/22/2011, Cape Cod Bay. Whale sighted by PCCS aerial survey. PCCS response team removed and retained all gear. Gear was sent to NMFS.

WR-2011-02: Right whale #3010, 1/19/2011, off Florida. Whale sighted by NEFSC aerial survey, gear-free, south of the Cape and Islands on 4/22/2011.

WR-2011-03: Right whale #3712, 4/29/2011, Stellwagen Bank. Whale was originally seen off the Florida coast on 1/30/2011. This Massachusetts sighting was discovered during photo-analysis of NEFSC-SAS flight.

WR-2011-13: Right whale #3123, 3/30/2011, Cape Cod Bay. Case was discovered during photo-ID analysis by PCCS from sightings on 4/14/2011 and 4/29/2011.

WR-2011-05: Right whale #3760, 4/25/2011, Cape Cod Bay. Whale with very cryptic entanglement – case discovered during photo-analysis by PCCS.

WR-2011-12: Minke whale, no ID, 5/6/2011, Martha's Vineyard Sound. Entangled carcass discovered by commercial fisher. WHOI and IFAW towed carcass ashore for necropsy. Gear sent to NMFS.

WR-2011-14: Humpback whale, no ID, 5/30/2011, east of Cape Cod. Whale sighted by beachgoers as it towed red and white buoy. No response was mounted due to a delay in reporting and distance from port. No photo-documentation exists.

WR-2011-15: Humpback whale, '09 calf of Lavalier, 6/3/2011 and 6/30/2011, Jeffreys Ledge. Entanglement discovered by whale watch as it returned to port. PCCS could not respond due to distance and sea state. NMFS and USCG responded but did not re-sight whale during search on 6/3/2011. (Whale was subsequently disentangled outside of grant period.)

Outside of the response area PCCS fielded calls and/or supported efforts for at least 13 other cases, including: six right whales off the Southeast coast (WR-2010-21, WR-2010-23, WR-2011-03, WR-2011-05, WR-2011-06, WR-2011-07); three humpbacks off the Mid-Atlantic and Maine coasts (WR-2011-01, WR-2011-04, WR-2011-09); an entangled humpback carcass in the Bay of Fundy (WR-2010-22) and three entangled minke whales off the Maine coast (WR-2010-14, WR-2010-15 and WR-2010-16).

Considering the inherently dangerous nature of disentanglement activities and the unpredictability of entanglement sightings PCCS continued in-house readiness and training efforts through on-water and land-based training sessions, greatly enhancing team and equipment readiness. Training sessions emphasized safety protocols and in many instances significantly decreased entanglement response time (planned training events were often underway when reports came in) and increased team visibility on the water. During the report period the PCCS response team held five on-water training sessions. In coordination with NMFS, PCCS also hosted two marine mammal responders from Puerto Rico for a one-week training session in May, 2011.

The PCCS response team continued to support ALWDN communications while NMFS finalizes the next generation disentanglement network web site/database. During the reporting period 60 html pages were updated or added to the current network site and significant sightings were broadcast via a Yahoo! Groups® email service. Both the email listserv and password protected web site accounts were maintained continuously.

OUTREACH

Outreach activities were targeted at public and professional audiences. PCCS responders authored, co-authored and presented at the 2010 Right Whale Consortium conference: First use of a cutting broadhead to resolve a right whale entanglement, Scott Landry, Brian Sharp and Lisa Sette; Entanglement severity related to rope characteristics for North Atlantic right whales, Amy Knowlton,

Scott Landry, Hank McKenna and Tim Werner; as well as contributions to the annual report card. Data collected during this and prior grants/contracts by the PCCS Right Whale Habitat Program were presented at the 2010 Right Whale Consortium conference: How much is enough? *Estimating the nutritional requirements of North Atlantic right whales with a generalized bioenergetics model*. Sara Fortune, Charles Mayo, Michael Moore, Andrew W. Trites. Additional presentations were given by Dr. Charles Mayo at the Review of OCS and SAMP Wind Energy Plans at URI in November 2010 and Foraging behavior of right whales and the risk of ship strike at the US Navy/PCAD meeting in Boston, June 2011. The PCCS response team conducted various activities to share information that enhanced entanglement awareness and ALWDN response efficiency. Directed outreach efforts were held for the Massachusetts Lobstermens Association, the National Parks Service – Cape Cod National Seashore, the Gulf of Maine Naturalist Workshop, the Massachusetts Maritime Academy and the Massachusetts Striped Bass Association. Public awareness of entanglement and disentanglement activities was achieved through a variety of media including public talks (18 during the time period), the PCCS public web site and newsletter, as well as news articles and interviews. These efforts generally emphasized the dangers of disentanglement, the need for entanglement reporting and the conservation aspects of entanglement.

Two abstracts have been submitted to the 2011 Right Whale Consortium conference. The anticipated presentations entitled: Changes in the residency pattern of right whales in the Cape Cod Area: trends and management impacts. Laura Ganley, Christy Hudak, Robert Lynch, Karen Stamieszkin, Charles A. Mayo, and Long-term trends in right whale behavior: a harbinger of habitat change? Christy Hudak, Laura Ganley, Karen Stamieszkin, Robert Lynch, Amy Costa, Charles A. Mayo, contain data collected during this and prior grants/contracts. One abstract has been submitted to the Biennial Conference of the Society for Marine Mammalogy: North Atlantic right whales: Are they nutritionally stressed? Sara Fortune, Charles Mayo, Michael Moore, Wayne Perryman, Heather Pettis, and Andrew W. Trites. Three publications have been submitted or are in preparation for submission: Weekly predictions of North Atlantic right whale (*Eubalaena glacialis*) habitat reveal influence of prey abundance and seasonality of habitat preferences. Daniel E. Pendleton, Patrick J. Sullivan, Moira W. Brown, Timothy VN. Cole, Caroline P. Good, Charles A. Mayo, Bruce C. Monger, Steven Phillips, Nicholas R. Record, Andrew J. Pershing. [ms Submitted to Journal of Endangered Species Research]; Predicting right whale feeding behavior. Karen, Stamieszkin, Solange Brault, Charles Mayo [ms in final draft]; Feeding and energetics of right whales in Cape Cod Bay [ms in prep].

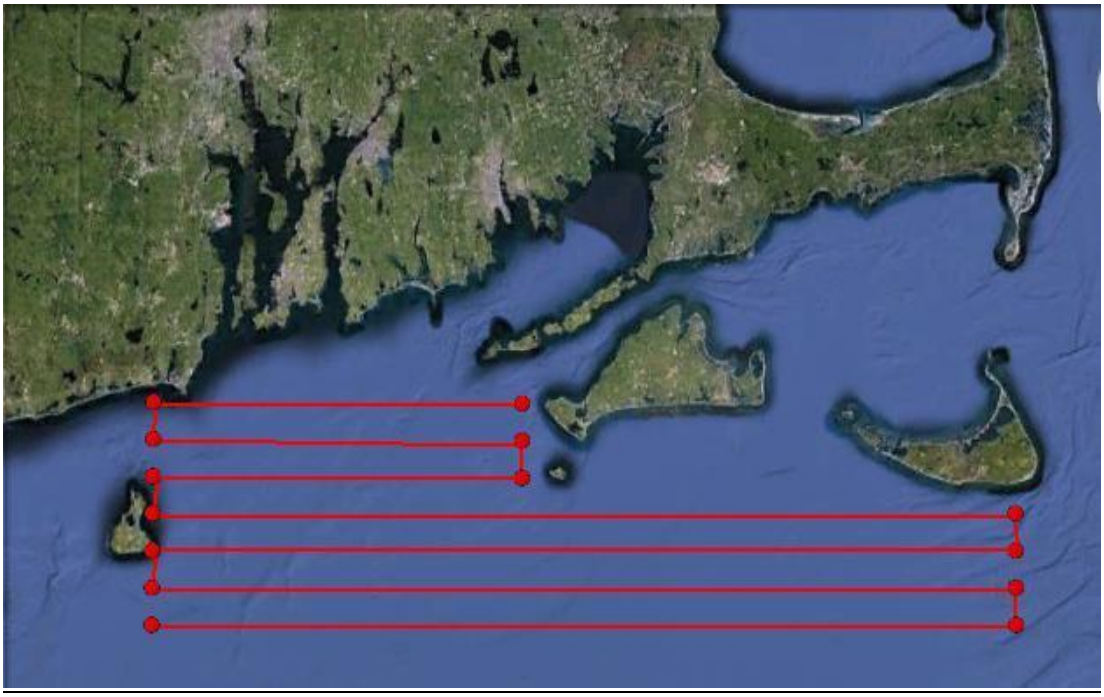


Figure 1: Proposed scheme for 2011 surveys of Rhode Island Sound and south of Martha's Vineyard and Nantucket.

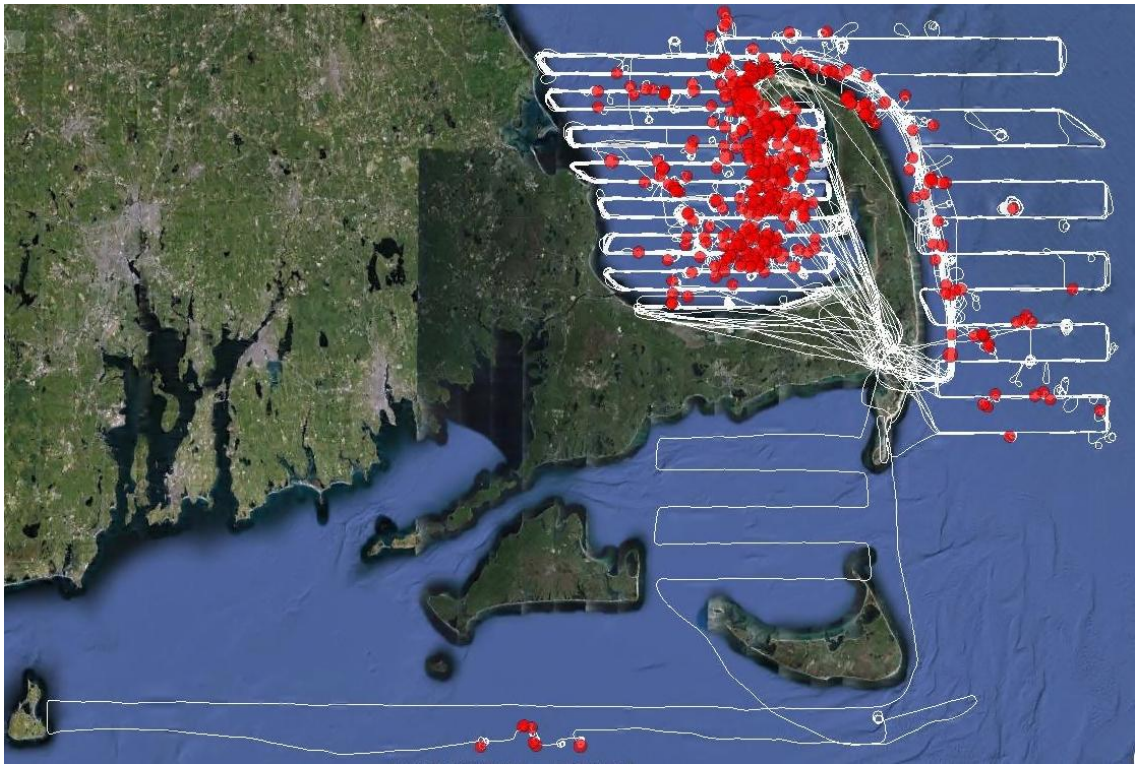


Figure 2: Aerial survey tracklines flown in 2011 in white. Red circles depict right whale sightings. Circle size coincides with the number of individual right whales seen.

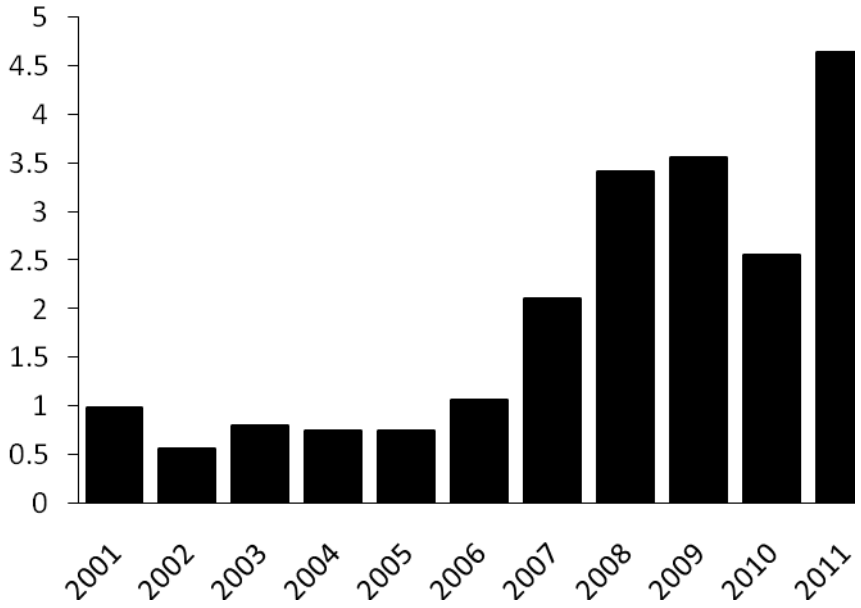


Figure 3: Number of right whales sighted per 100 nm of survey effort, recorded by the PCCS Right Whale Studies Program from the year 2001 to 2011, separated by year; data from 1998 to 2000 is currently unavailable.

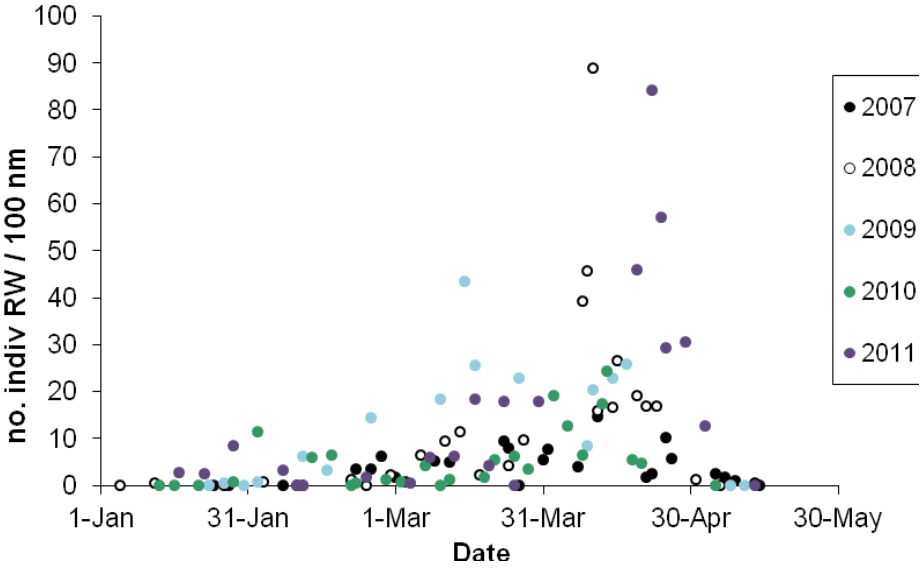


Figure 4: Number of right whales sighted per 100 nautical miles of flight, in Cape Cod Bay, recorded by the PCCS Right Whale Studies Program over the course of the survey season, 2007 through 2011, illustrating the typical period during which right whales use the Cape Cod Bay region.

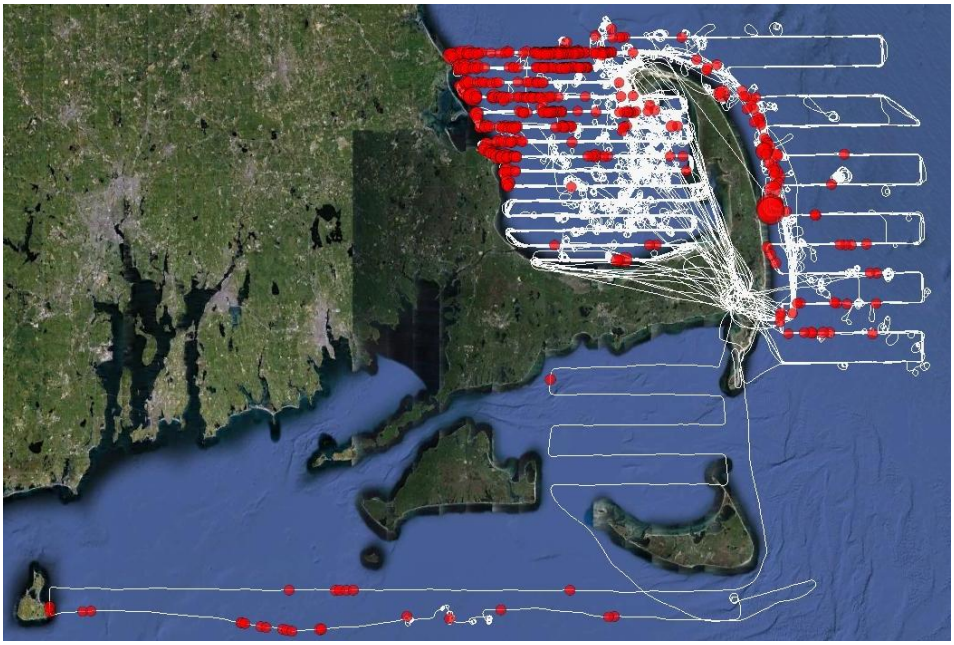


Figure 5: Fixed fishing gear sightings observed by the PCCS Right Whale Studies Program. Red circles depict sightings of at least one piece of fishing gear. Note: these are gear sightings observed in the vicinity of the aerial trackline effort and are not intended to present a comprehensive description of fixed fishing effort throughout the survey area**.**

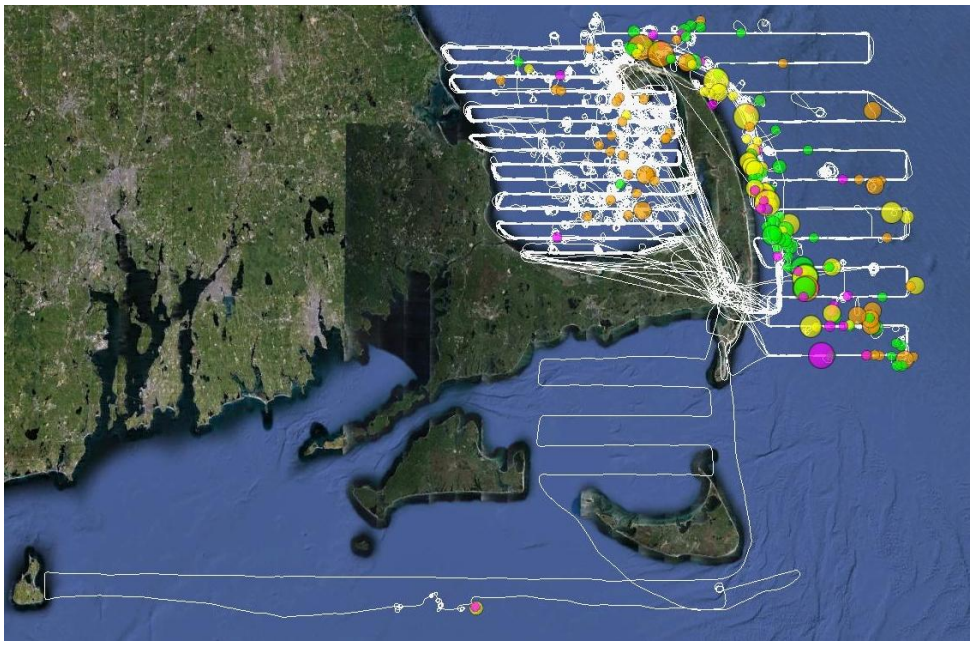


Figure 6: Fin whale, humpback whale, sei whale, and minke whale sightings observed by the PCCS Right Whale Studies Program. Circle size coincides with the number of individual whales sighted. Orange circles depict sightings of one or more fin whales, green circles depict sightings of one or more humpbacks, yellow circles depict sightings of one or more sei whales, and pink circles depict sightings of one or more minke whales.

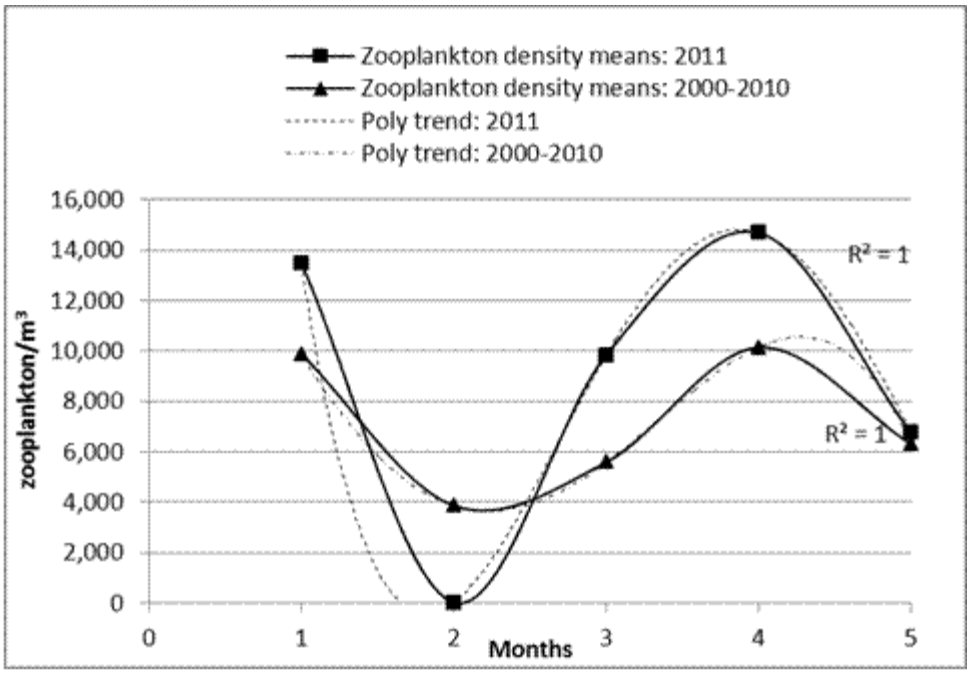


Figure 7: Comparison of mean zooplankton densities per month of all stations (within A & P whale proximity) between previous 10 year period and 2011 field season. (A = 3 – 100 meters, P = < 3 meters)

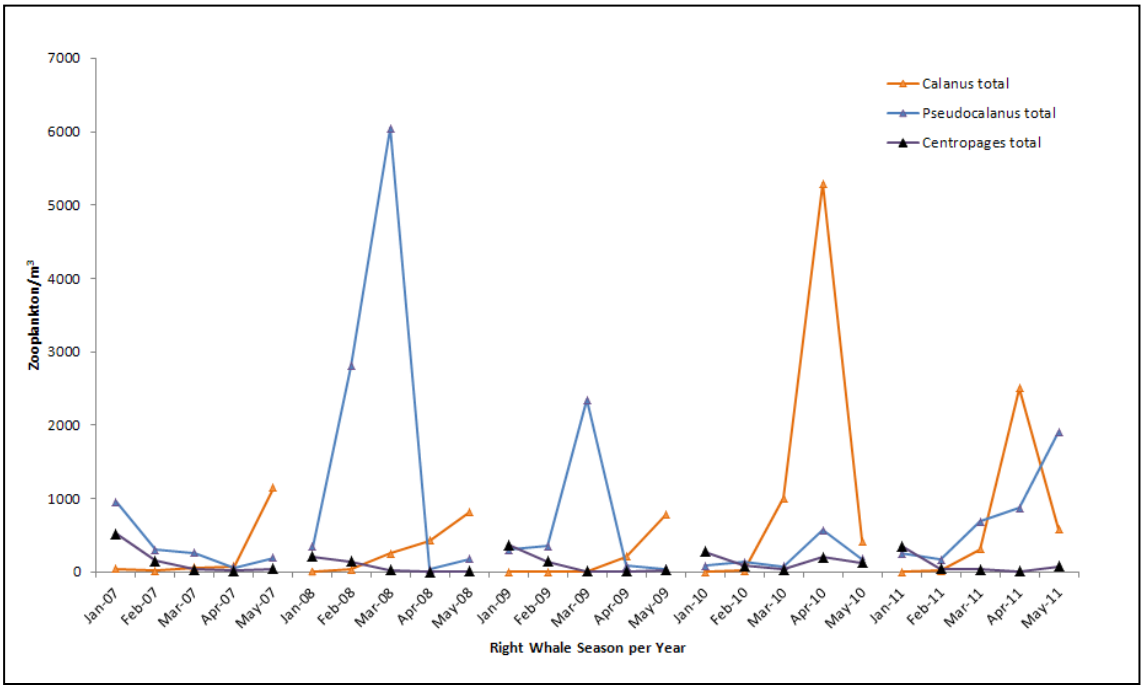


Figure 8: Monthly mean zooplankton densities of surface tows at regular stations: 2007-2011. Calculations do not include special stations.

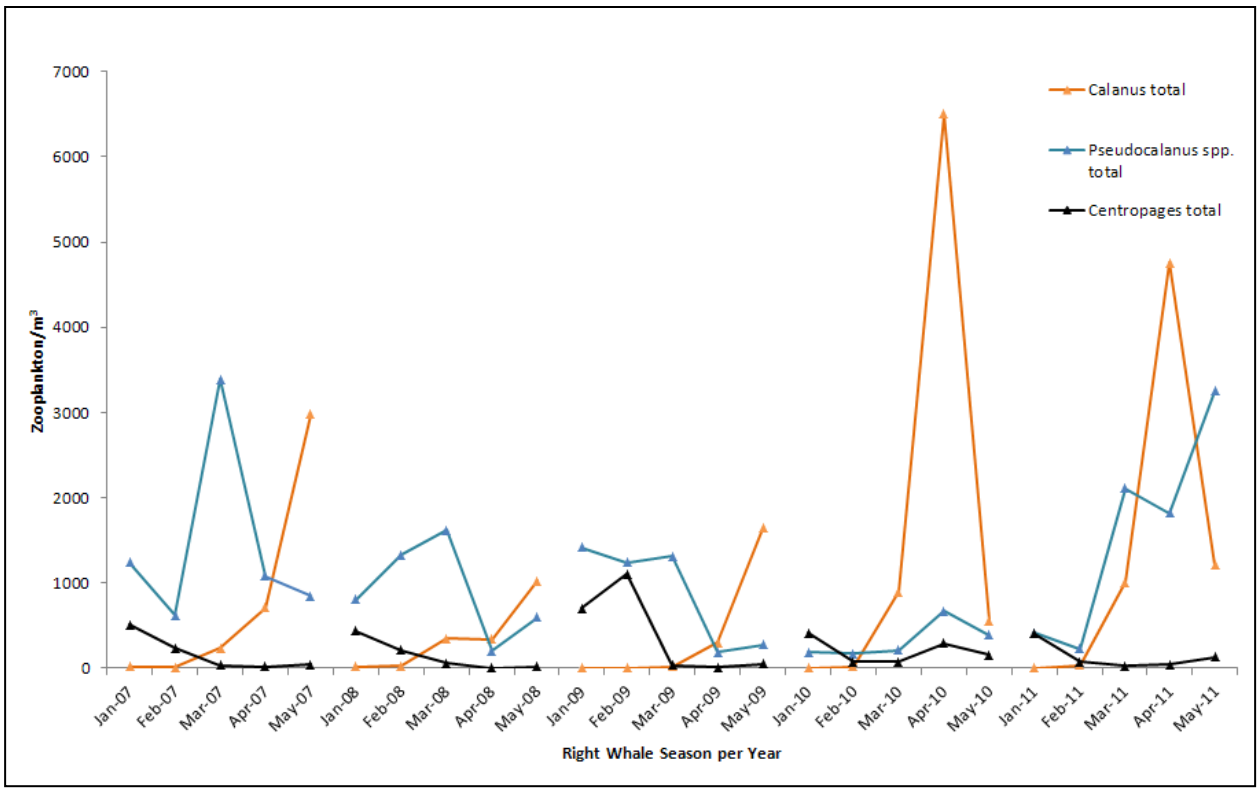


Figure 9: Monthly mean zooplankton densities of oblique tows at regular stations: 2007-2011. Calculations do not include special stations.

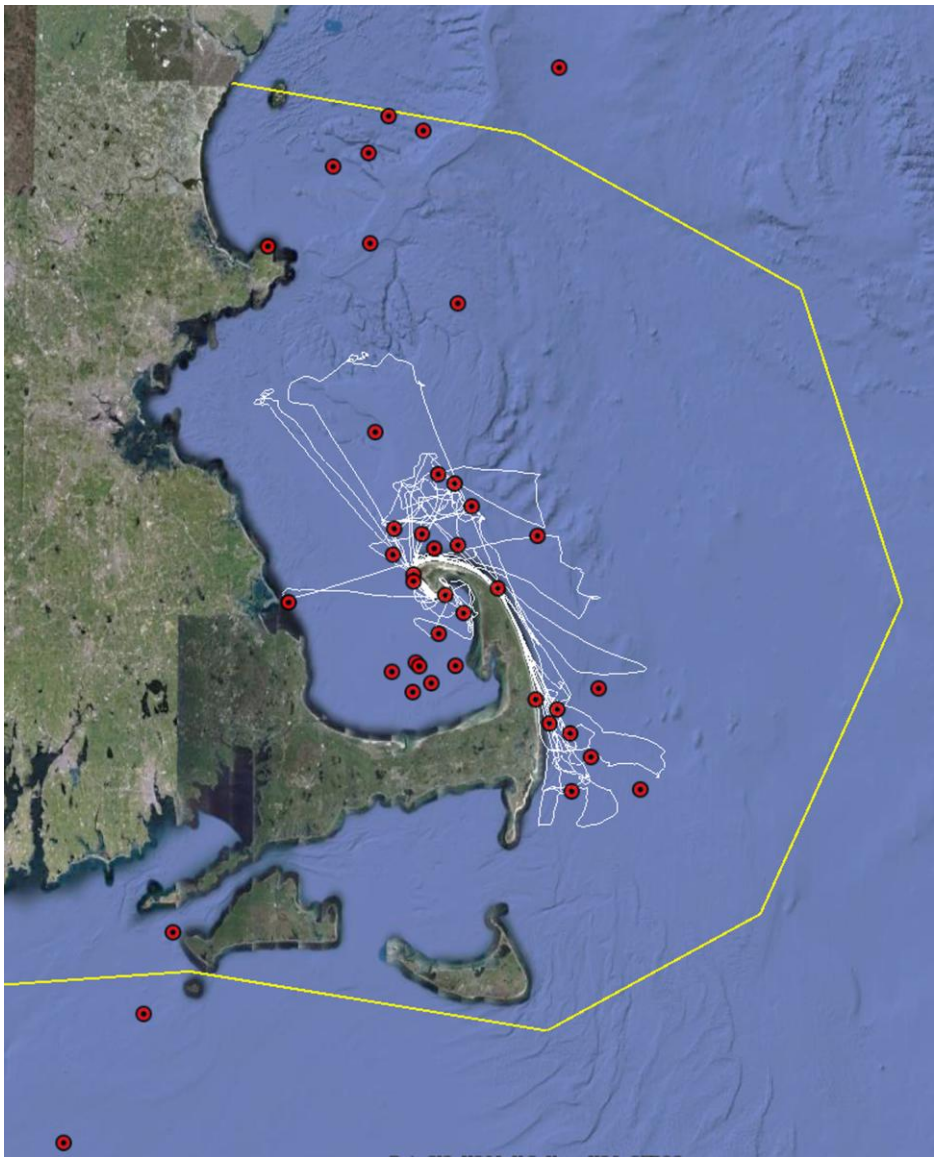


Figure 10. PCCS core response area and confirmed whale entanglement sightings between July 1, 2010 and June 30, 2011. White tracklines also shown.

Table 2. 2011 Cape Cod Bay Habitat Cruises: Samples Collected and Analyzed

		ZOOPLANKTON SAMPLES					
Cruise	**Date**	**On-Station Surface Tows**	**Off-Station Surface Tows**	**On-Station Oblique Tows**	**Off-Station Oblique Tows**	**Pump Samples***	**Total**
SW800	6 Jan	4	2	4	.	.	**10**
SW801	29 Jan	7	.	7	.	12	**26**
SW803	7 Feb	8	.	8	.	.	**16**
SW804	17 Feb	5	2	5	1	.	**16**
SW805	24 Feb	7	.	7	.	.	**13**
SW807	17 Mar	3	3	3	.	34	**14**
SW808	23 Mar	8	1	7	.	.	**43**
SW809	30 Mar	.	1	.	.	60	**16**
BF048	7 Apr	.	.	.	3	.	**3**
SW811	8 Apr	1	2	1	1	112	**117**
SW812	14 Apr	.	7	.	.	47	**54**
SW813	15 Apr	.	2	.	.	7	**9**
SW814	19 Apr	1	6	2	.	57	**66**
SW815	22 Apr	3	6	3	.	46	**58**
SW816	25 Apr	1	4	1	.	109	**115**
SW818	29 Apr	7	2	7	.	17	**33**
SW819	2 May	3	5	3	.	8	**19**
SW820	14 May	7	.	7	.	.	**46**
	Totals	**65**	**43**	**65**	**5**	**509**	**687**

***** collected by filtering a pumped volume of water from either 1) the near-surface as the vessel steamed along a horizontal transect, or 2) specific depths in the water column while the vessel was on-station

Table 3. 2011 Diel Study of Cape Cod Bay Vertical Profiles

Avg. total zooplankton	Morning (0600 – 1159 hrs.)	Afternoon (1200 – 1659 hrs.)	Evening (1700 – 2000 hrs.)
0-1 m	12,362.54	7,193.94	5,195.95
1.1-6m	12,617.59	8,895.63	5,157.20
6.1m +	9,213.55	6,965.25	4,548.68
Avg. Calanus finmarchicus	Morning	Afternoon	Evening
0-1 m	6,021.72	4,145.86	1,807.47
1.1-6m	7,205.48	5,174.60	2,388.38
6.1m +	3,484.53	2,222.82	950.08
Avg. Pseudocalanus spp.	Morning	Afternoon	Evening
0-1 m	3,880.66	2,171.93	1,576.82
1.1-6m	3,211.58	2,512.81	1,447.82
6.1m +	2,487.38	2,091.67	895.42
Avg. Centropages spp.	Morning	Afternoon	Evening
0-1 m	13.72	15.29	50.32
1.1-6m	20.59	26.98	45.29
6.1m +	276.98	66.07	88.50

(Average zooplankton densities (zooplankton/m^3) from vertical pump samples: Jan. – May, 2011.)

References:

Brown, M.W., Marx M.K. & Nichols O. 2001. Surveillance, monitoring & management of North Atlantic right whales, *Eubalaena glacialis*, in Cape Cod Bay, Massachusetts: January to Mid-May, 2001. A final report submitted to the Division of Marine Fisheries, Commonwealth of Massachusetts, and to the Massachusetts Environmental Trust, October 2001.

Durbin EG, Gilman SL, Campbell RG & Durbin AG (1995) Abundance, biomass, vertical migration and estimated development rate of the copepod *Calanus finmarchicus* in the southern Gulf of Maine during late spring. Continental Shelf Res. 15: 571-591.

Hays GC, Warner AJ & Tranter P (1997) Why do the two most abundant copepods in the North Atlantic differ so markedly in their diel vertical migration behavior? J. Sea Res. 38:85-92.

Leeney R.H., Stamieszkin K., Mayo C.A., & Marx M.K. Surveillance, monitoring & management of North Atlantic right whales in Cape Cod Bay and adjacent waters – 2009. Final Report, November 2009.

Leeney R.H., Stamieszkin K., Jaquet N., Mayo C.A., Osterberg D. & Marx M.K. 2008. Surveillance, monitoring & management of North Atlantic right whales in Cape Cod Bay and adjacent waters – 2008. Final Report, October 2008.

Pettis H. North Atlantic Right Whale Consortium 2010 Annual Report Card. Report to the North Atlantic Right Whale Consortium, November 2010.

Stamieszkin K., Ganley L., Mayo C.A., Leeney R.H., & Marx M.K. Surveillance, monitoring & management of North Atlantic right whales in Cape Cod Bay and adjacent waters – 2010. Final Report, November 2010.

ATTACHMENT A

Commonwealth of Massachusetts

Division of Marine Fisheries

1213 Purchase St. 3rd Floor

New Bedford, MA 02740

(508)990-2860

fax (508)990-0449

Paul J. Diodati

Deval Patrick

Governor

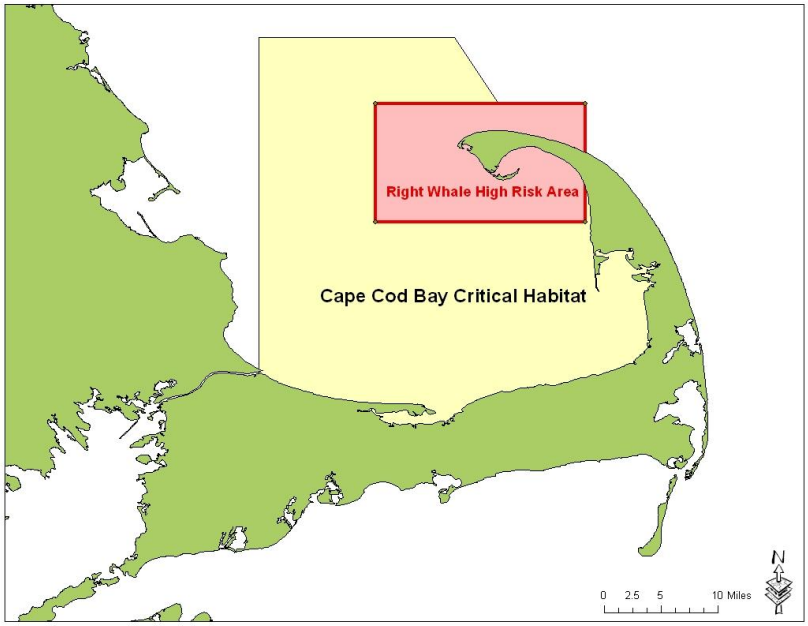
Timothy P. Murray

Lt. Governor

APRIL 15, 2011 - ADVISORY TO MARINERS

HIGH RISK AREA FOR RIGHT WHALES AROUND PROVINCETOWN

On April 14, 2011, the Division of Marine Fisheries and the Center for Coastal Studies documented a large aggregation of endangered North Atlantic right whales around Provincetown. A High Risk Advisory is being issued due to the number of whales, their behavior, their proximity to shore and the abundance of zooplankton in the area. Approximately 25 - 30 whales were seen sub-surface and surface feeding within 500 yards of the beach, from Race Point down to Long Point and inside to Truro. Dense concentrations of zooplankton at the surface and just below the surface are driving the whales' behavior. Whales that are surface and subsurface feeding are often difficult to see and at great risk for vessel strike. Vessel strike is a major cause of human-induced mortality for right whales. For the safety of both mariners and whales, **vessel operators in this area are strongly urged to proceed with caution, reduce speed (less than 10 knots), and post lookouts to avoid colliding with this highly endangered whale.**



Based on zooplankton resources collected on April 14, we expect that this aggregation of whales will persist for several more days to perhaps a week. This advisory is will be lifted when right whales depart the area.

Federal law prohibits vessels greater than 65 feet in length from exceeding speeds of 10 knots in Cape Cod Bay during this time of year; however right whales are still vulnerable to collision with smaller vessels.

Vessel traffic is expected to increase in this area over the next few weeks with seasonal increases in recreational and commercial fishing, as well as whale watching, and passenger ship activity. Right whales are the most endangered large whale in the North Atlantic, with a population of approximately 450 animals.

Vessels are also prohibited by state and federal law from approaching within 500 yards of a right whale. Massachusetts Environmental Police and U.S. Coast Guard are authorized to enforce the 500-yard rule. Vessels that find themselves within 500 yards of a right whale should slowly and cautiously exit the area.

Management of maritime activities near right whales is part of the *MarineFisheries* Right Whale Conservation Program. The Right Whale Conservation Program is a cooperative effort between *MarineFisheries*, the Provincetown Center for Coastal Studies (CCS), and the National Marine Fisheries Service to study and protect right whales in Cape Cod Bay.

The National Marine Fisheries Service (NOAA Fisheries) issues notices to mariners via the Northern Right Whale Sighting Advisory System (SAS). Participating agencies in the SAS include *MarineFisheries* and the Massachusetts Environmental Police, the U.S. Coast Guard, the U.S. Army Corps of Engineers (ACOE), CCS, and other research groups. Advisories can be viewed at the NOAA Fisheries Northeast Region web site (http://www.nefsc.noaa.gov/psb/surveys/) and are broadcast over NOAA weather radio (http:// 205.156.54.206/nwr/).

For more information, visit the *MarineFisheries* website at www.mass.gov/marinefisheries or contact Erin Burke (Erin.Burke@state.ma.us, 978 551-0152) or Dan McKiernan (dan.mckiernan@state.ma.us, 617 626-1536). Center for Coastal Studies (www.coastal studies.org) right whale researcher Dr. Charles (Stormy) Mayo can be reached at (508) 487-3623.